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JUN 4 1935

AGRICULTURAL NEWS LETTER

VOL. 3 - NO. 6

JUNE 1935

THIS PUBLICATION GIVES INFORMATION on new developments of interest to agriculture based on the work done by scientists and agricultural field men of the du Pont Company and its subsidiary companies.

It also gives reports of results obtained with products developed by these companies in the field whether the tests are made by field men of the companies, by agricultural experiment stations or other bodies. Also data on certain work done by agricultural stations on their own account and other matters of interest in the agricultural field.

This issue contains:

Greenhouse Fumigation with Hydrocyanic Acid Gas;
the Methods Followed and Precautions to be Taken.

The Role of "Loro" in the California Citrus Spraying Schedule and the Results Obtained.

Control of Mexican Mealy Bugs on Infested
Chrysanthemums Under Greenhouse Conditions.

Illinois Publication Discusses Flea Beetles and
Methods of Control of Pests on Tomatoes.

"Cel-O-Glass" Shown to Have Important Applications
in the Poultry, Horticultural and Some Other Fields.

Urea as a Fertilizer Material Is Shown to Possess
Certain Distinct Advantages.

Blasting Tap-Rooted Stumps in the South Plays
Part in CCC Soil Erosion Projects.

Index to Numbers One to Six, January-June, 1935, Volume Three.

Issued by
Publicity Bureau,
E. I. du Pont de Nemours & Co.,
Wilmington, Del.

GREENHOUSE FUMIGATION WITH HYDROCYANIC ACID GAS;
THE METHODS FOLLOWED AND PRECAUTIONS TO BE TAKEN

EDITOR'S NOTE:- The use of lethal gas for the control of certain insects in greenhouses -- discussed here by an authority on the subject -- is certain to be of wide interest. Acknowledgment of cooperation in making this contribution available is made to Prof. W. P. Flint, Entomologist, Illinois Agricultural Experiment Station.

By C. C. Compton, Associate Entomologist,
State Natural History Survey Division,
Agricultural Experiment Station,
University of Illinois, Urbana, Ill.

Hydrocyanic acid gas has been used as a greenhouse fumigant for more than twenty years. Originally the gas was produced by dropping sodium cyanide into a mixture of sulfuric acid and water. This is known as the pot method of cyanide fumigation. During the past ten years most of the cyanide used in the greenhouse has been in the form of calcium cyanide. This slate-gray granular material gives off the hydrocyanic acid gas without the use of pots, acid and water. For certain insects such as aphids or greenfly, the calcium cyanide method has several advantages. The gas is evolved slowly and gives a low concentration of gas over a period of several hours. This low concentration of gas is less dangerous from the standpoint of the operator.

Mealy Bugs and Thrips

There are certain pests in the greenhouse, namely the Mexican mealy bug and several species of thrips which thrive on plants which do not have a very wide margin of safety when fumigated with cyanide. For fumigating such plants the older pot method of cyanide fumigation can be used to advantage by increasing the dosage and shortening the period of exposure. For example the Mexican mealy bug on chrysanthemums can be practically eliminated from the average greenhouse by making two pot fumigations about two weeks apart. For this work a dosage of one-half ounce sodium cyanide for each 1,000 cubic feet for an exposure of one-half hour is recommended. This method is particularly well adapted for use in large greenhouses, open ranges of the ridge and furrow type, and old greenhouses that leak gas readily. When fumigating large greenhouses with a low concentration of gas there is a tendency for the gas to drift or pile up in one end of the house, resulting in injury to certain plants. Also the necessity of having a rising temperature is often a problem in a large house. With the short period of exposure, that is, thirty minutes, there is less danger of drift or piling up of the gas in one end of the house or range and there is less danger of a serious

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temperature drop. It is also possible to fumigate safely at higher temperatures with the relative high concentration of gas for a short period than is possible with a relatively low concentration of gas for an exposure of several hours to over night. Temperatures 75° to 78° F. are most effective in killing the Mexican mealy bug, Phenacoccus gossypii and aid materially in obtaining a satisfactory kill of the common mealy bug, Pseudococcus citri and several species of thrips. In our experiments at Illinois we have fumigated chrysanthemums at the one-half ounce dosage of sodium cyanide with an exposure of one-half hour at temperatures in excess of 85° F. without injury. Plants very susceptible to cyanide injury such as Asparagus sprengeri, can be successfully protected by covering with newspapers or muslin. Asparagus sprengeri, A. plumosa, sweet peas and snapdragons should never be fumigated with any form of cyanide unless protected. The pot method is not recommended for fumigating greenhouse roses. Roses are more safely fumigated with the calcium cyanide.

When to Fumigate

In fumigating such greenhouse crops as chrysanthemums the fumigations should be started in early summer as soon as the plants have become well established in the bench. When the plants are small they are very severely injured by such insects as the Mexican mealy bug and thrips. It is recommended that the fumigating be done just before the plants are pinched. This allows for the removal of any injured tips that may result from fumigating when conditions are not right. In fumigating any greenhouse crop, it should be borne in mind that satisfactory results are obtained only when the dosage is such that the insects are overcome without overcoming the resistance of the plants.

Equipment, Materials and Methods

Greenhouse men in general are familiar with the handling of calcium cyanide. The pot method of cyanide fumigation has been out of use for so long a time that a review of the method may be of value. Fumigation with the pot method should not be attempted unless the operator is willing and capable of following directions. If directions are followed it is less dangerous than duck hunting. Many of the older growers have used the pot method in the past and are familiar with its use.

The materials necessary for the pot method of fumigation are the generators, sodium cyanide, sulfuric acid, 1 lb. paper sacks, a 16 ounce measure and water. Two-quart earthenware crocks are commonly used as generators. Where crocks are not available, six or seven inch flower pots with the drainage plugged with a cork work equally well. When flower pots are used they should be pre-soaked in water for an hour or so before they are to be used so that they will not take up too much of the water to be placed in the crocks. One crock or pot to each 7,000-10,000 cubic feet is sufficient.

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The sodium cyanide used should be 98-99 per cent pure. This material is manufactured in "egg" form, each "egg" weighing approximately 1 ounce. This makes weighing unnecessary. Commercial sulfuric acid having a specific gravity of at least 1.83 or testing 66° Baume is satisfactory for fumigation work. The small 1 lb. paper sacks are used to hold the cyanide.

Preparing for Fumigation

In preparing a greenhouse for fumigation, the watering should be done not later than early morning of the day the fumigation is to be put on. When conditions permit, watering the day before is preferred. It should be borne in mind that in fumigating with any form of cyanide the plants should be dry and the greenhouse should have a relative humidity below 70 per cent. There is sometimes a tendency among greenhouse men to get the plants too dry at the roots. Plants that are approaching a wilting condition are more easily injured than a plant that has been well watered. The main point is to have the surface of the soil free from excessive moisture and the walks and ground under the benches dry. For mealy bug control the temperature should be raised to at least 70° F. and better results are obtained if the temperature is 75° to 78° F. The relative humidity in the house should be 70 per cent or lower. If the precautions regarding watering have been followed, this condition is easily obtained. After closing the ventilators fumigation may be started.

Steps to be Taken in Fumigation

- (1) Before fumigating, the cubical contents of the house must be figured. This is obtained by multiplying the width of a house by the average height and then by the length.
- (2) Determine the number of crocks or pots required by allowing one pot for each 7,000 to 10,000 cubic feet. In houses 30 feet or less in width, the pots may be spaced evenly along the middle walk. In wider houses two or more walks should be used.
- (3) Determine the number of ounces of sodium cyanide, acid and water to use. Allow one-half ounce of sodium cyanide for each 1,000 cubic feet. For each ounce of sodium cyanide (each "egg") allow $1\frac{1}{2}$ fluid ounces sulfuric acid and 2 fluid ounces water. For example: A greenhouse 30 feet wide, 200 feet long with a 7 foot gutter and 13 foot ridge would contain 60,000 cubic feet of space. The amount of sodium cyanide required for one-half ounce dosage would be 30 ounces. Allowing one pot for each 10,000 cubic feet, 6 pots would be required with 5 ounces of sodium cyanide to each pot. Then each pot would require 5 ounces sodium cyanide, $7\frac{1}{2}$ fluid ounces sulfuric acid and 10 fluid ounces water.

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- (4) After the above determinations the required amount of water is measured into each pot and the pots spaced evenly along the center walk.
 - (5) The required amount of sulfuric acid is measured into glass bottles and one glass bottle placed beside each pot.
 - (6) The required number of sodium cyanide "eggs" are placed in 1 lb. paper sacks and one sack placed beside each jar. Wash the hands thoroughly after handling the cyanide.
 - (7) Starting at the end of the house with a door for exit, pour the acid slowly into each jar. DO NOT ADD THE CYANIDE. If more than one line of jars are used, one man must be assigned to each line or walk.
 - (8) When all men have reached the last jar and the acid has been added the paper sack with the cyanide is carefully dropped into the pot. LEAVE IMMEDIATELY AND GO TO THE NEXT POT. This process is continued until the last jar has received the cyanide. THEN LEAVE THE HOUSE AT ONCE. All doors should be locked or plainly marked with signs indicating poison gas.
 - (9) The house is then kept closed for one-half hour, after which time it is ventilated. The ventilator shaft may be extended to the outside of the greenhouse and the ventilators opened from the outside. If the ventilators cannot be opened, the operator must put on CYANIDE mask to enter the greenhouse to open the ventilators. It is essential to use a mask supplied with a CYANIDE canister since other gas masks will not give protection for cyanide. Every greenhouse using cyanide in any form should be equipped with a CYANIDE mask to take care of emergencies. Such masks can be obtained at prices ranging from \$7.50 to \$20.00.
- The time required to ventilate a house will vary from 15 to 30 minutes.
- (10) After fumigation the residue left in the crocks should be buried in the ground and the pots washed before being put away. Always wash the hands thoroughly after handling the cyanide.

Precautions

- (1) Do not fumigate on windy or rainy nights or in daylight hours.
- (2) Do not fumigate with cyanide when the greenhouse adjoins a dwelling unless the inhabitants vacate.

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- (3) Do not fumigate when the plants have recently been dusted or sprayed with compounds containing copper. Dr. Guba has recently shown that cyanide can be used with safety following applications of some of the newer copper compounds.

SUMMARY

Tests conducted in Illinois during the past two years have shown that the use of the older pot method of cyanide fumigation should not be discarded. Many plants will stand a relatively high concentration of hydrocyanic acid gas for short periods of exposure. This method has proven particularly effective in controlling mealy bugs and thrips on chrysanthemums and gardenias. The labor involved in using the pot method is greater than with calcium cyanide but for mealy bugs and thrips a more complete cleanup is effected.

THE ROLE OF "LORO" IN THE CALIFORNIA CITRUS SPRAYING SCHEDULE AND THE RESULTS OBTAINED

EDITOR'S NOTE:- Dr. Swain describes here the rather revolutionary change in insect control in California citrus orchards resulting from the use of a new type of contact insecticide from fatty alcohols. He presents facts of commanding importance to entomologists and the growers of citrus fruits.

By A. F. Swain, Entomologist,
The Pacific R. & H. Chemical Corporation,
El Monte, California.

There is a very definite need in the California citrus orchards for a non-oil contact insecticide that can be used at all seasons of the year. The variety of insect pests and the fact that the period of their susceptibility to insecticides varies with the type of insect, complicated the control problem. At present the principal control methods for the scale insects consists of fumigating with hydrocyanic acid gas, and spraying with highly refined petroleum oils. Both of these have their limitations. Fumigation is specific for scale insects, and even for them in some districts, it is not entirely satisfactory because of the presence of the so-called "resistant" scale (an ecological strain which is so tolerant to cyanide fumigation that satisfactory control is not always obtained with concentrations that can be used with safety to the trees). Oil sprays are limited as to the season of the year in which they can be applied. There is a definite trend away from the use of oil sprays on the part of the citrus growers because of the adverse effect of oil on the trees, and on the quality and production of fruit. For other insect pests, miscellaneous insecticides have been necessary, such as nicotine sulfate as a specific for aphids, a selenium compound for red spider, fluorines for worms, sulphur for thrips, and so forth.

"Loro"*, a composition of lorol rhodanates, was introduced commercially into the California citrus districts this past winter for the control of citrus aphids and has proved effective for that purpose. There is a general impression that reinfestation of aphids is delayed longer following an application of Loro than from other generally used aphicides. Further observations, however, are needed before this can be made a definite claim. In some of the first groves sprayed with Loro for aphids, it was noted that excellent control of black scale was obtained. In fact, scale up to the so-called "rubber stage" were killed, equalling the best fumigation or oil spray results. As it so happened, there has been an extremely heavy infestation of black scale this spring, largely due to the fact that weather conditions last winter prevented many growers from fumigating.

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This has resulted in a demand for Loro at a time of year when neither fumigation nor oil sprays could be applied with safety to the trees.

"Loro" for aphids control has been used at the rate of 1-800 and has not required the addition of any spreader. Where black scale also has been present, the addition of an equal amount of a light-medium soluble oil has increased the kill, so that at present, the standard practice for spring treatment calls for Loro at 1-800 with a light-medium soluble oil at 1-800, equivalent to a pint of each per 100 gallons of spray. This application has proven a boon to the growers because no single insecticide heretofore introduced would control both pests without the probability of incurring injury. For this alone it has a very definite place in the citrus spraying program.

In addition to the above, Loro has been effective in holding down infestations of red spiders. This latter pest usually builds up in the spring to such heavy infestations that serious damage results. Heavy oil sprays are quite effective as a control, but cannot be used with safety to the trees in the spring. A selenium compound has been the only reasonably satisfactory material for control of the spring infestations of spiders, but this material is specific for red spider only. On the other hand, Loro to date has kept trees free from red spiders since the latter part of January, and has also proved an effective insecticide in the control of aphids and black scale, with a single application.

In experiments for the control of red spiders, it was found that the addition of a small amount of a light medium soluble oil to Loro stepped up the control from a period of five or six weeks to one of several months. Since then it has been well demonstrated that the oil is of value in scale control as well. "Loro" and soluble oil should be mixed together before adding them to the water in the spray tank. As already stated, Loro and oil at the rate of one pint of each to 100 gallons of spray is recommended for scale and spider control. With this small amount of oil, the combination is considered in connection with citrus spraying as a non-oil spray. In fact, when used with oil at double that strength, as is sometimes done, the combination is still essentially a non-oil spray.

Operators who have used Loro are well pleased with it, not only because of its efficiency, but also because of the fact that it is not unpleasant to use, has no harmful effects on the men spraying, spreads excellently, and is non-injurious to the trees and fruit. "Loro" has been used at all seasons of the year in widely scattered localities, and under a great range of weather conditions on over 150,000 trees, with no reports of any injurious results. It is one of the most interesting insecticides to be introduced to the citrus industry in California. It has now been demonstrated on a commercial scale that Loro has a definite place in the citrus spray program.

* "Loro", the trade name for a composition of lorol rhodanates developed and manufactured by the Grasselli Chemical Company, Cleveland, Ohio.

CONTROL OF MEXICAN MEALY BUGS ON INFESTED CHRYSANTHEMUMS UNDER GREENHOUSE CONDITIONS

EDITOR'S NOTE:- We give herewith a few extracts from a very interesting article entitled - "A Progress Report on the Insecticidal Control of the Mexican Mealy Bug (*Phenacoccus Gossypii* T. and Ckll.) on Greenhouse Chrysanthemums" by Dr. Henry H. Richardson, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Since its first reported presence in California in 1917 the Mexican mealy bug has spread widely over most of the southern and central states and as far north as Michigan and New York. In addition to attacking a wide range of plants, such as citrus, eggplant, tomato, okra, hollyhock, and geranium, it has become an outstanding pest of greenhouse chrysanthemums. Losses of 40 to 50% of this crop are not uncommon. It stunts the plants, distorts and mars the appearance of the foliage, attacks the flowers, and if not controlled will kill the plant outright. The severity of its attack is no doubt due in part to the large number of eggs laid.

Sprays and Dusts

A number of dusts and sprays have been tested on infested chrysanthemums under greenhouse conditions. The applications were made as thoroughly as possible, the dust being applied with a small hand duster and the sprays with a paint sprayer at 15 lbs. constant pressure. Mortality counts were made four or five days after the applications, all eggs being removed shortly after spraying and in some cases being set aside for record of hatching.

The dusts had little effect. Just recently sulfur dust (300 mesh) was tried. It had little effect on the active stages but killed considerable numbers of eggs (82.2% of 621 eggs). Further tests corroborated these results, indicating that sulfur dust has some promise, but larger scale tests have not been made. Of the sprays, those with nicotine were evidently the least effective even where the other extractives of tobacco were present. Both the derris and pyrethrum sprays, when used with the same wetting agent, were more effective than nicotine. The organic thiocyanates, especially the mixture of lauryl and other similar aliphatic thiocyanates, killed slightly more of the active stages than any of the above, were tolerated by the plants, and in addition had an exceptional toxic effect on the eggs. In addition to its high contact action at the time of spraying, recent tests have shown definitely that this spray exerts a residual toxic action over a period of several days after spraying. Young, first stage nymphs and nymphs in the process of hatching

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are especially affected. Apparently there is a fumigating effect on some of the eggs. The present cost of some of the thiocyanates compares very favorably with that of kerosene emulsions and they appear promising for use where a spray is needed.

Summary

The Mexican mealy bug has become widely dispersed in the United States, being particularly injurious to greenhouse chrysanthemums, where it is responsible for losses as high as 50% of the crops. Derris, pyrethrum and tobacco dusts were ineffective for control. Sulfur dusts showed some promise, killing high percentages of the eggs. Various sprays of the concentrations tested differed in the following order from lesser to greater effectiveness.

1. Soaps
2. Nicotine
3. Pyrethrum or derris
4. Organic thiocyanates
5. 10% Kerosene emulsion

Lauryl and other thiocyanates killed a high percentage of eggs and exerted a residual action for several days after spraying.

ILLINOIS PUBLICATION DISCUSSES FLEA BEETLES AND METHODS OF CONTROL OF PESTS ON TOMATOES

EDITOR'S NOTE:- Interesting and valuable information is given in Illinois Circular 428, "Tomato Diseases and the Insect Pests -- Identification and Control" by K. J. Kadow and L. H. Shropshire, Agricultural Experiment Station, University of Illinois, Urbana, Ill. Below are excerpts from this circular.

Tomatoes are attacked by several species of flea beetles. The most important of these are the potato and eggplant flea beetles. The adults of these insects are about 1/16" long, brownish-black, and very active when disturbed.

Injury Caused by Attacks

Flea beetle injury to tomatoes is usually most severe during the early growing season. Severely injured plants look as if they had been peppered with fine shots, the leaves being filled with small holes on which the beetles have fed. These usually dry out and cause the death of the leaf or plant. The young of flea beetles attack the root and lower stems of some crops, but are not of much importance on tomatoes.

Control with Dust or Spray

Young tomato plants should be closely watched especially after they are transplanted, and control measures applied upon the first signs of injury. Either a dust or spray may be used effectively to control flea beetles on tomato plants if the plants are thoroughly covered. Untreated parts of the plant are quickly detected and fed upon by the beetles.

Barium fluosilicate*, calcium fluosilicate, or arsenate of lead may be used against these insects on small plants, but should not be used after the fruit appears.

If fluosilicates are used they should be mixed with talc or flour according to the directions of the manufacturer.

Life History and Habits

Flea beetles spend the winter in the adult stage under trash and rubbish in or near the tomato field. In the spring they emerge and feed for a while upon wild plants and later upon the tomato and other cultivated crops. Eggs are laid in the soil around plants upon which the adults feed. They hatch after a few days, producing small white or yellowish white larvae which feed upon the roots and lower stem. One or two generations are produced each year.

*"Dutox" is the trade name registered by the Grasselli Chemical Company, Cleveland, Ohio, to cover this product.

"CEL-O-GLASS" SHOWN TO HAVE IMPORTANT APPLICATIONS
IN THE POULTRY, HORTICULTURAL AND SOME OTHER FIELDS

EDITOR'S NOTE:- The material described here is for window uses and other purposes. Its properties offer possibilities in the raising of poultry, in horticulture, in the home and for experimental work.

A study of Cel-O-Glass* recently completed indicates that it has a far wider field than was at first supposed. "Cel-O-Glass" is a flexible transparent plastic coated material with a wire mesh base. It has been found especially important to those who wish to protect and propagate plants in cold weather, to prevent rickets in baby chicks as well as to increase egg production and hatchability and it has also been successfully used by physicians to prevent and cure rickets in infants. It is now being used as a new decorative medium.

The studies indicate that this material admits about thirty percent of the total ultra-violet rays of the sun. In addition it filters out the infra-red rays. This transmission and filtration, which are exactly the reverse to the action where ordinary window glass is used, means that Vitamin D is admitted by means of the transmission of the ultra-violet rays but without danger of burning and possible poisoning since the infra-red rays are excluded.

Tests indicate that it has great strength. One square foot of Cel-O-Glass will support approximately two hundred pounds, thus rain, hail and snow cannot break it. It is unaffected by cold and will stand more than 300 degrees Fahrenheit. In regard to insulating qualities, it has been found to increase the interior temperature from ten to twenty degrees more than glass does.

Various studies have been made of the different results of using this material. The bibliography concerning work done on it includes:

Antirachitic Effect of Winter Sunshine Through Cel-O-Glass: Results of Experimentation on Rats, American Journal of Diseases of Children, May 1930, Vol. 39, pp. 969-979.

Antirachitic Value of Winter Sunlight in the Latitude of 42° 21' (Boston) by Edwin T. Wyman, M. D.; Philip Drinker, S. B., Ch. E.; and Katherine H. Mackenzie, R. N., Boston, reprinted from the American Journal of Diseases of Children, May, 1930, Vol. 39, pp. 969-979 by the American Medical Association, 535 North Dearborn Street, Chicago, Ill.

Continued on next page

Atmospheric Pollution and Sunlight, Transactions of the American Society of Mechanical Engineers.

Bi-monthly Bulletin Vol. XI, No. 4, whole No. 121, Ohio Agricultural Experiment Station, report of Dr. R. M. Bethke and D. D. C. Kennard, July-August, 1926.

New Jersey Agricultural College Experiment Station, Forty-ninth annual report, 1928.

Outwitting Jack Frost, Harry R. O'Brien, Acetol Products, Inc., 1932.

Poultry Husbandry, Moreley A. Jull, Senior Poultry Husbandman, U. S. Department of Agriculture. McGraw-Hill.

Poultry Science, Vol. VI, No. 2, Report of Professor Walter F. Ward, Jr., Vermont State School of Agriculture, December-January, 1926-27.

Transactions of the Illuminating Engineering Society, Vol. XXIII, No. 3, A Preliminary Report of the Measurement of Variation of Energy in the "Vita Spectrum" of the Sunshine in Kansas, by J. S. Hughes and R. L. Pycha, 1928.

Ultra-Violet Light and Vitamin D Studies, Thesis by C. H. Howard, Ph. D., Rutgers University, 1930.

University of Arkansas, Fortieth Annual Report, Bulletin #231, 1928.

University of Wisconsin, Bulletin #405, Report on Energy Production.

Value of Some of the Glass Substitutes in Growing Chicks, by R. L. Cochran and H. A. B. Heubender, Bulletin #246, Iowa State College, 1928.

* "Cel-O-Glass" is a registered trade name. This material is produced by the Fine Chemicals Division of E. I. du Pont de Nemours & Company, Wilmington, Del.

UREA AS A FERTILIZER MATERIAL IS SHOWN TO POSSESS CERTAIN DISTINCT ADVANTAGES

EDITOR'S NOTE:- Supplementing several technical discussions of urea, which have appeared in this publication, we present here a popular article on this fertilizer material. It is believed that the information might be of value to county agricultural agents and others in the preparation of bulletins and otherwise.

By O. F. Jensen, Ammonia Department,
E. I. du Pont de Nemours & Company.

Urea is a water-soluble organic compound containing 46 per cent nitrogen. It is the source of more than one-half of the nitrogen in farm manure, and as such has long been recognized as an excellent source of nitrogen for all crops.

Many experiments have been conducted in recent years with urea supplying a part or all of the nitrogen in fertilizers applied for various crops. In these official tests, which have included cotton, corn, tobacco, potatoes, watermelons, strawberries, and various vegetable crops, urea has usually given as good or better results than any other form of nitrogen. The experiences of practical farmers have also confirmed these tests, indicating that urea is equal, and frequently superior, to high-grade organics from the standpoint of both yield and quality of crop.

Urea is a Readily Available Source of Nitrogen

Urea is readily available to plants before it undergoes any change. When urea is added to soil, however, it rapidly changes to ammonium carbonate. Ammonium carbonate is a form of nitrogen that is very rapidly absorbed by plants in the seedling stage. Urea, therefore, is quick-acting.

Urea Nitrogen Does Not Leach Readily

Although urea is 100 per cent water-soluble, the loss of urea nitrogen is no more than that from high-grade natural organics. The reason for this is that the ammonium carbonate (formed from urea) reacts with the soil acids, and thereby becomes relatively insoluble, although still available to plants. Later on, the ammonium compounds are gradually changed to nitrates, which are generally absorbed by the plants as fast as they are produced. There is

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little danger, therefore, of loss of urea nitrogen by leaching. This has been shown in many field experiments.

Urea Causes a Desirable Initial Decrease in Soil Acidity

Even a neutral fertilizer may temporarily increase soil acidity, due to the "salt effect". This temporary increase may be minimized or prevented by urea in the fertilizer. The ammonium compounds formed from urea neutralize soil acids, and make conditions very favorable for rapid growth of the seedling. Some high-grade natural organics have a similar action, but per unit of nitrogen are less effective than urea.

Residual Effect of Urea Only Slightly Acidic

In its final or residual effect on soil reaction, urea is only slightly acidic, like high-grade natural organics. Pound for pound of nitrogen, urea is one-third as acid-forming as sulfate of ammonia. The use of urea in fertilizers simplifies acidity control, which has come to be recognized as an important factor in the feeding of plants.

Urea is used by fertilizer manufacturers in the form of dry or crystal urea, and in a solution known as Urea-Ammonia Liquor. The latter product has several advantages from the standpoint of the manufacturer, and from the standpoint of the fertilizer user, supplies exactly the same urea as in the crystal form.

Manufacturers have been quick to adopt urea in their formulas. Formerly an expensive material, urea in Urea-Ammonia Liquor now costs no more than inorganic nitrogen, and much less than natural organics, with which it has many fertilizer properties in common.

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Properties of Urea and Other Sources of Nitrogen

	<u>Urea</u>	<u>Natural Organics</u>	<u>Nitrate Nitrogen</u>	<u>Ammonium Salts</u>
Rate of decomposition in the soil	very rapid	rapid	-	-
Availability to the crop	high	high	high	high
Losses by leaching from soil	slight	slight	heavy	slight
Initial effect on soil reaction	basic	basic	acid	acid
Residual effect on soil reaction	slightly acid	slightly acid	basic	very acid
Crop return in field experiments	excellent	excellent	excellent*	excellent**
Cost per unit of nitrogen	low	very high	moderate	low

*When leaching is not serious.

**When acidity is not too high or is corrected by the use of liming materials.

BLASTING TAP-ROOTED STUMPS IN THE SOUTH PLAYS PART IN CCC SOIL EROSION PROJECTS

EDITOR'S NOTE:- This description of methods of blasting tap-rooted stumps is timely, in view of the fact that members of the Civilian Conservation Corps are now engaged in assisting farmers prevent soil erosion. In an early issue of this publication, Mr. Livingston will describe ways to blast lateral-rooted stumps. Later, he will contribute an article on the use of explosives in gully control work.

By L. F. Livingston, Manager,
Agricultural Extension Section,
E. I. du Pont de Nemours & Co.

Under the terms of an arrangement whereby members of the Civilian Conservation Corps -- approximately 100,000 men divided into about 500 camps -- will engage in soil erosion projects, the farmers whose lands are involved will be required to terrace their farms. The CCC men will do the work on outlets.

Naturally, it will be necessary for farmers to remove from the terrace lines such obstructions as boulders and stumps, in order that terracing equipment may be used. This, in many cases, will necessitate the use of explosives for boulder and stump blasting.

In the Southern States, stumps are mostly of the tap-rooted type. These may readily be blown out by the use of dynamite. It is necessary, however, for the sake of efficiency and economy that the proper procedure be followed. How to proceed depends upon various factors. These include the kind and quantity of dynamite. Also, to be taken into consideration are such matters as the size of a particular stump, its root anchorage, condition of the wood--whether solid or partly rotted -- the condition of the soil and its moisture content. Only by making test shots can the blaster determine how best to do the work.

In general, it can be said that green stumps require 3 times more explosives than partly rotted ones. If the stumps are in lighter soil or in sand or gravel, larger charges are necessary. Less dynamite is required when the soil is moist.

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Where to Place the Charge

The cause of unsatisfactory stump blasting is the failure of the blaster to place the explosive charges in their proper location. He should thoroughly examine the stump to learn its condition and the location of anchoring roots, or the probable diameter of the tap-root.

One method of blasting is to place the dynamite at the side of a stump. This requires the earth be dug out to the proper depth to provide a hole to receive the charge. In such a case priming may be done with a blasting cap and fuse, or blasting may be done electrically, using an electric blasting cap and a blasting machine.

Another method is to place charges at either side of a stump. Since both are shot at one time, it is necessary to use the electric method of firing.

Still another method is loading the dynamite into the tap-root. This requires the use of a wood auger to bore a hole. The hole is bored diagonally to the right depth and to about the middle of the tap-root. This may be fired by cap and fuse or electrically.

Loading Instructions

Where the dynamite is placed alongside a tap-root, a tamping stick should be inserted in the hole to make sure that there are no obstructions that would prevent proper loading. This, of course, should be done before any of the explosives is put in.

If a number of sticks of dynamite are required -- as is usually the case -- slit the wrappers of all but one of the cartridges, using the point of a knife to make three or four lengthwise slits. If, however, the earth is wet, the wrappers should not be slit. The moisture content may be determined by squeezing earth taken from the hole.

Use a wooden tamping stick to push the slit cartridge to the bottom of the hole, and tamp the dynamite firmly. Then insert a primed cartridge. It should not be slit. Pour in a handful of dry earth and tamp gently. Continue filling and tamping solidly until the hole is filled. Be careful not to disturb the fuse or wires while tamping.

The same procedure is followed in loading a hole bored in a tap root.

Fuse should be slit at the end to expose the powder and make it easy to light.

A medium fast-acting explosive is best for blasting pine tap-rooted stumps, as it will cut off the tap-root and split the upper portion of the stump, making its removal easy.

Users of explosives should familiarize themselves with safety practices and observe them strictly.

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INDEX TO NUMBERS ONE TO SIX, JANUARY-JUNE, 1935, VOLUME THREE

NOTE: This index is for the convenience of readers who preserve copies of this publication. Copies of back numbers are not available.

<u>Explosives, Agricultural</u>	<u>Month</u>
The Successful Blasting of a Ditch in Frozen Ground. Points to Possibilities of Winter Uses of Dynamite.....	January
Blasted Ponds to Provide Water Supply as Drought Insurance for Many Farmers.....	February
Farmers Advised to Make Dams or Ponds to Conserve Water in Event of Drought.....	March
Ponds Blasted With Dynamite Serve Different Useful Purposes on Farm.....	April
Cleaning Out Drainage Ditches and Farm Ponds or Water Holes.....	May
Blasting Tap-rooted Stumps in the South Plays Part in CCC Soil Erosion Projects.....	June

Fertilizers

New Facts About Fertilizer Materials Result from Research and Experiments.....	February
Methods of Reducing the Retail Prices of Fertilizers Indicated by Investigations.....	March
The Relation Between the Equivalent Acidity of Sources of Nitrogen and Their Efficiency in Potato Fertilization Subject of Research.....	April
Urea as a Fertilizer Material is Shown to Possess Certain Distinct Advantages.....	June

Insecticides -- Fungicides

New Combined Sprays for Citrus Trees Contains Ethyl Mercury Oleate in Oil.....	January
---	---------

Continued on next page

Higher Alcohol Sulfates as Spreading Agents
for Insecticides and Fungicides are Studied..... March

Sulfated Alcohols in Insecticides
Indicate Favorable Characteristics..... April

New Contact Insecticides from Fatty Alcohols;
Their Development and Tests of Their Toxicity..... May

The Role of "Loro" in the California Citrus
Spraying Schedule and the Results Obtained..... June

Plant Foods

Zinc is Essential to Plant Growth
Experiment Station Research Shows..... February

Manganese -- A Plant Poison Which
Plants Must Have to Live and Grow..... March

Seed Disinfectants

Different Types of Seed Grain Disinfectants
and Factors to be Considered When Selecting..... January

Discovery and Development of Formaldehyde
and Its Applications to Seed Disinfection..... January

The Potato Crop, Some Diseases and
Seed Disinfection With Formaldehyde..... February

Kansas Oats Yields Increased 31.9 percent
by Treating Seed With Organic Mercury Dust..... February

Treating Seed Grain for Control of Diseases
is Urged by U. S. Department of Agriculture..... March

Seed Treatment in Drought States
is a Matter of Utmost Importance..... April

Seed Treatment as an Aid to Better
Corn Yields This Year is Advocated..... May

Continued on next page

Miscellaneous

- Wildlife Conservation Linked With Problem
of Retirement of Vast Areas of Farm Lands..... January
- Wild Game as a Source of Income for Farmers
to be Discussed at American Game Conference..... January
- Opening Of Industrial Toxicology Laboratory
Inaugurates Significant Scientific Research..... February
- Controlling Fungous Sap Stains of Lumber
by Use of Mercurial Fungicide Treatments..... March
- The Chinch Bug Outbreak in the Corn Belt
and the Methods Adopted to Effect Control..... April
- Damping-Off of Seedlings Controlled
by New Method of Using Formaldehyde..... May
- The Interdependence of Agriculture
and the American Chemical Industry..... May
- Greenhouse Fumigation With Hydrocyanic Acid Gas;
The Methods Followed and Precautions to be Taken..... June
- Illinois Publication Discusses Flea Beetles
and Methods of Control of Pests on Tomatoes..... June
- Control of Mexican Mealy Bugs on Infested
Chrysanthemums Under Greenhouse Conditions..... June
- "Cel-O-Glass" Shown to Have Important Applications
in the Poultry, Horticultural and Some Other Fields..... June

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